

Eight additional new records of Philippine Mosses

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Abstract

Eight new taxa are added to the Philippine moss flora: *Acroporium rigens* (Broth. ex Dixon) Dixon, *Braunfelsia plicata* (Sande Lac.) Broth., *Brotherella fauriei* (Cardot) Broth., *Bryoerythrophyllum recurvirostrum* (Hedw.) P.C.Chen, *Gammiella pterogonoides* (Griff.) Broth., *Oxyrrhynchium hians* (Hedw.) Loeske, *Pterogonidium pulchellum* Hook. and *Vesicularia ferriei* (Cardot & Thér.) Broth. The genus *Pterogonidium* is new to the Philippine flora.

New records

Linis and Tan (2008), as well as subsequent publications by Linis (2010) and Linis and Tan (2010), estimate the total moss flora for the Philippines as 755 species in 238 genera and 56 families. However, continued study of the many unidentified bryological collections kept at the Philippine National Herbarium (PNH), including those of the senior author, has added eight new species and one generic record. These additions bring the total moss taxa known to occur in the Philippines to 763 species and 239 genera.

All voucher specimens of these Philippine mosses are held in PNH with some duplicates distributed to the Herbarium of Singapore Botanical Gardens (SING) for reference purposes.

1. *Acroporium rigens* (Broth. ex Dixon) Dixon

Sematophyllaceae

In the field typical plants of *Acroporium rigens* are tufted, with erect, acrocarpous-like branches which can often be mistaken for small plants of *Pyrrhobryum spiniforme* (Hedw.) Mitt. *Acroporium rigens* is most similar to *A. johannis-winkleri* Broth., with which it shares the bristly plant habit and similar erect-divergent, narrowly lanceolate-linear and tubulose leaves (Tan 1994, Tan *et al.* 2007). *Acroporium rigens*, however, is much larger with stems and branches ascending to 2 cm in height. Moreover, the rigid and setaceous leaves of *A. rigens* are longer than those of *A. johannis-winkleri* with their length reaching to 5 mm as compared to the latter with leaf length only to 2 mm.

Distribution: Malay Peninsula, Philippines, and Borneo (West Malesia) and Papua New Guinea (Western Melanesia) (Tan 1994, Tan *et al.* 2007).

Specimens examined: PHILIPPINES: Panay Island, Antique Province, Mount Baloy, on moist stone; 1,650 m, 9 Oct 1989, J.R. Cabalquinto 1229 & E. Sagcal, Jr. (PNH). MALAYSIA: State of Penang, Penang Hill, base of frond of *Cyathea*; 700 m, 13 Apr 1971, H.N. Ridley 5605 (SING). State of Johor, Gunung Belumut, on lower part of tree trunk in mossy forest; 914 m, May 1923, R.E. Holttum 10998 (SING).

2. *Braunfelsia plicata* (Sande Lac.) Broth.

Dicranaceae

Apart from its deeply plicate curved leaves, *B. plicata* is similar in size, habit, color and other morphological details to *B. dicranoides* (Dozy & Molk.) Broth. *Braunfelsia plicata* tends, however, to have a more sharply defined costa and blunter leaf apices.

Distribution: a West Malesian endemic recorded in Indonesia (Java, Sumatra) and the Malay Peninsula (Eddy 1988), now found in the Philippines.

Specimens examined: PHILIPPINES: Mindanao Island, Bukidnon Province, Malaybalay City, Barangay Busdi, Sitio Magantol, on tree trunk; transitional lowland forest, 1,220 m, 17 May 2008, V.C. Linis 3617-08 (PNH); *ibid.*, V.C. Linis 3624-08 (PNH). MALAYSIA: State of Kedah, Kedah Peak, in very mossy place, on ground, just below summit; 1158 m, 1 Apr 1925, R.E. Holttum 14869 (SING). Borneo, State of Sarawak, Mount Dulit, Dulit Range, on tree trunk in moss forest; 1300 m, 6 Oct 1932, P.W. Richards M2167 (SING).

3. *Brotherella fauriei* (Cardot) Broth.

Pylaisiadelphaceae

Brotherella was at one time combined with *Pylaisiadelpha* retaining the latter as the name of the merged genus (Buck 1984), but the move did not meet full acceptance (Jia & He 2006; Afonina *et al.* 2007). Ando *et al.* (1989) had clarified the distinction between *Brotherella* and *Pylaisiadelpha* and their differences include poorly differentiated leaf alar cells and the presence of filiform propagules in *Pylaisiadelpha*. Furthermore, Tan and Jia (1999) observed that the exothecial cell walls of *Pylaisiadelpha yokohamae* and *P. tenuirostris* exhibit weak collenchymatous thickening, quite unlike the uniformly, thick vertical walls with thin lateral walls in exothecial cells in species of *Brotherella*. Although recent phylogenetic studies using a limited number of gene sequences have shown the species of the two genera to be inseparable molecularly, we are keeping them apart based on their morphological distinction.

Recent molecular studies (Buck *et al.* 2000; Tsubota *et al.* 1999, 2000, 2001a, b, 2002) have shown that Sematophyllaceae *s.l.* includes two sister clades: the core sematophyllous taxa (e.g. *Acanthorrhynchium* Fleisch., *Acroporium* Mitt., *Meiothecium* Mitt., *Papillidiopsis* Buck & Tan, *Sematophyllum* Mitt. and *Trichosteleum* Mitt.), and a clade that includes *Brotherella* Loeske ex Fleisch., *Heterophyllum* (Schimp.) Kindb. in Fleisch., some species of *Hypnum* Hedw., *Isocladiella* Dix., *Platygyrium* Schimp., *Pylaisiadelpha* Cardot, *Taxithelium* Spruce ex Mitt. and *Wijkia* Crum. Tsubota *et al.* (2001a) called the latter clade the ‘*Brotherella* lineage’, while Goffinet and Buck (2004) described a new family Pylaisiadelphaceae for it. Although this clade lacks any obvious morphological synapomorphy, we follow Goffinet and Buck (2004) in placing *Brotherella* in the family Pylaisiadelphaceae.

Brotherella fauriei is another addition to the growing number of *Brotherella* species reported from the Philippines. Unlike other Philippine species of *Brotherella*, however, *B. fauriei* is a slender plant with distantly spaced branches. The mostly erect-patent stem and branch leaves with more or less falcate leaf acumina are distinctive.

Distribution: Temperate East Asia mainly in China and Japan (Tan & Jia 1999).

Specimens examined: PHILIPPINES: Luzon Island, Benguet Province, Mount Santo Tomas, on exposed roots of pine (*Pinus kesiya*) tree, 1,900 m, 29 Nov 1988, J.R. Cabalquinto 332, J.F. Barcelona & M.Y. Bangis (PNH). CHINA: Jiangxi Province, Zixi County, Mount Ma-Tou, on decaying log, 890 m, 26 May 2001, M.C. Ji 12668 (SING).

4. *Bryoerythrophyllum recurvirostrum* (Hedw.) P.C.Chen

Pottiaceae

Recent phylogenetic analysis of eight Russian *Bryoerythrophyllum* suggested the genus is monophyletic (Fedosov & Ignatova, 2008). In the Philippines, these *Barbula*-like plants can normally be identified in the field by the markedly rufous coloration of their older parts.

Among its congeners, *Bryoerythrophyllum recurvirostrum* is closest to *B. ferruginascens* (Stirt.) Giac. However, unlike the latter which is dioicous, *B. recurvirostrum* is synoicous and/or paroicous. *Bryoerythrophyllum recurvirostrum* also differs from *B. ferruginascens* by being bigger with stems reaching 3 cm compared to 17 mm. Furthermore, *B. recurvirostrum* has flexuose leaves up to 3 mm long with margins recurved nearly to apices, with few teeth near the tips vs leaves reaching 1.3 mm in length with entire margins recurved only up to mid-leaf. The lack of rhizoidal gemmae, which are present in *B. ferruginascens*, is also helpful in identifying *B. recurvirostrum*.

Distribution: almost cosmopolitan in both Northern and Southern Hemispheres, reaching Malesia. Recorded from the island of New Guinea and Indonesia (Sulawesi) (Eddy 1990).

Specimen examined: PHILIPPINES: Luzon Island, Benguet Province, Kabayan, Mount Pulag, on soil; 1,600 m, 18 Oct 1988, J.R. Cabalquinto 211 & E. Sagcal, Jr. (PNH).

5. *Gammiella pterogonioides* (Griff.) Broth.

Sematophyllaceae

This species is distinguished from its congeners by its relatively large size. The imbricate, cordate and ovate to oblong-lanceolate leaves with abruptly cuspidate leaf apices are also distinctive. This is the fourth species of *Gammiella* reported from the Philippines.

Distribution: Eastern India, Himalayas, Indochina and southwest China (Gangulee 1969–1980; Tan & Jia 1999) to the Philippines.

Specimen examined: PHILIPPINES: Luzon Island, Benguet Province, Baguio City, Wright Park, on bark of pine (*Pinus kesiya*) tree; 1,400 m, 27 Jan 1989, J.R. Cabalquinto 474 & B.O. van Zanten (PNH)

6. *Oxyrrhynchium hians* (Hedw.) Loeske

Brachytheciaceae

This is the second species of the genus reported in the Philippines and it is superficially very similar to *O. vagans* (Jaeg.) Ignatov & Huttunen in the field with both taxa possessing subjulaceous branch foliage. However, *O. hians* has shorter median laminal cells (35–105 µm) in its well-developed branch leaves compared to those of *O. vagans* measuring 70–145 µm (Ignatov *et al.* 2005). When fertile, *O. hians* has rough setae compared to those of *O. vagans* being smooth (Ignatov *et al.* 2005).

Distribution: widespread in warm temperate areas of North America, Europe, East Asia (China, Japan, the Philippines) and the Himalayas (India, Nepal and Bhutan) and also in Africa (Ignatov *et al.*, 2005).

Specimens examined: PHILIPPINES: Luzon Island, Benguet Province, Mount Santo Tomas, on rocky trail; 7,300 ft, 17 Apr 1956, N. Velaira 1 (PNH); Luzon Island, Nueva Vizcaya, 1 km. east of Dalton Pass, on fallen, rotting log near creek; 1,500 m, 4 Mar 1967, R.M. del Rosario 587 (PNH); Luzon Island, Camarines Sur Province, north slope of Mount Isarog, on stone; 16 May 1991, J.R. Cabalquinto 2192 (PNH). **ROMANIA:** Moldavia, Iasi, in opp. Iasi in loco nominato Copou, ad terram uliginosam; 80 m, 16 Mar 1916, C. Oescu s.n. (SING).

7. *Pterogonidium pulchellum* Hook.

Hypnaceae

This is the second report of this invasive moss species from the Neotropics in Asia. The first report was made by Tan & Buck (2002), when the authors discovered two populations on a tree trunk (*Melaleuca* sp.) inside the National Orchid Garden of the Singapore Botanic Garden. Re-examination of *P. pulchellum* using data from *rbcL* gene sequences showed that it has a close relationship with members of Hypnaceae (Chang *et al.* 2006).

Distribution: common in West Indies and Central America reaching northern South America (Sharp *et al.* 1994; Tan & Buck 2002), reported now in SE Asia from Singapore and the Philippines.

Specimens examined: PHILIPPINES: Luzon Island, Benguet Province, Baguio City, Barangay Pacdal, Baguio Botanical Garden, on lower trunk of an ornamental tree, near a human settlement area; 1,476 m, 22 Jan 2011, V.C. Linis 4754-11 (PNH). **SINGAPORE:** Botanical Gardens of Singapore, on *Melaleuca* tree trunk; 6 Nov 1998, B.C. Tan 98-472 (SINU).

8. *Vesicularia ferriei* (Cardot & Thér.) Broth.

Hypnaceae

Tan and Iwatsuki (1991) reported five taxa of genus *Vesicularia* (Müll.) Müll. for the Philippines. *Vesicularia ferriei* is somewhat similar to *V. montagnei* (Bél.) Broth. in having ovate dorsal leaves and suborbicular lateral leaves with short leaf apices. However, *V. ferriei* is readily distinguished by the broadly acute or obtuse leaf apices rather than shortly acuminate as in *V. montagnei*. Furthermore, the median laminal cells of both dorsal and lateral leaves in *V. ferriei* are linear-hexagonal or elongate-rectangular compared to oblong-hexagonal in *V. montagnei*.

Distribution: in temperate East Asian regions of Japan and China (Noguchi *et al.* 1994), also in the Philippines.

Specimens examined: PHILIPPINES: Mindanao Island, Cotabato Province, Kidapawan City, Barangay Ilo-mavis, Sitio Agco, on tree fern trunk along trail leading to waterfalls near small lake; 1,600 m, 29 Mar 2011, V.C. Linis 4900-11 (PNH). **JAPAN:** Honshu Island, Hiroshima-ken, Hiroshima-shi, Asa-kita-ku, Uga George, along Takayama River, on wet boulder by stream; 200 m, 26 Mar 1998, H. Deguchi s.n. (SINU). **CHINA:** in confinibus provinces of Kianghsi and Fukien, Mt. Dangwa-schan, inter Schitsheng and Ninghwa, in lacuna quadam in cacumine cum Glossadelpho; 1400 m, May 1921, T. H. Wang s.n. (SING).

Discussion

The distributional patterns exhibited by the eight newly reported Philippine moss taxa are relevant and useful to phytogeographical studies of the Philippine moss flora. The additions of *Brotherella fauriei*, *Oxyrrhynchium hians* and *Vesicularia ferriei* for the Philippine moss flora further fortify its predominantly East Asiatic

composition (Tan 1992, Linis & Tan 2008) while the discovery in the Philippines of *Acroporium rigens* and *Braunfelsia plicata* from Western Malesia and *Gammiella pterogonoides* from the Himalayan/ Indochina/ Hainan areas maintains the current relationships of moss floras between Philippines and these regions.

Bryoerythrophyllum recurvirostrum adds to the growing list of cosmopolitan taxa already recorded in the country. *Pterogonidium pulchellum* is the first record of an introduced moss taxon in the country.

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